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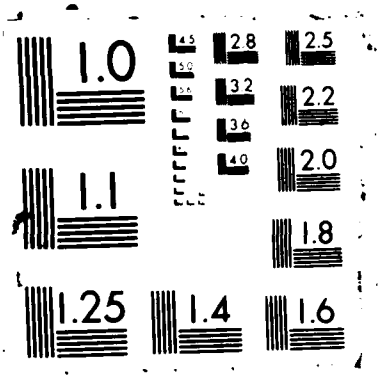
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Applications of Multivalent Ionic Conductors To Polymeric Electrolyte Batteries

by

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Paper to be presented at
6th International Meeting on Solid State Ionics
Garmisch-Partenkirchen
September 6-11, 1987

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Fast ion conduction has been demonstrated in certain polymer materials doped with an alkali metal salt. Recently divalent salts have also been used in the preparation of ionically conducting polymers. Certain complexes (namely the Mg^{2+} based) were found to be anion conductors while others (namely the Pb^{2+} based) were cation conductors. It is therefore of interest to study the reasons for the apparent difference. A.C. conductivity measurements are currently being evaluated on a number of polymer divalent salt complexes. Electrochemical cells are being constructed with appropriate cathodes to assess the feasibility of these polymer electrolytes in rechargeable batteries. One such design

$$Mg/(PEO)_4 \cdot Mg(ClO_4)_2/V_6O_{13}$$

has an open circuit voltage of 2V and a theoretical energy density of 346 Wh/kg. Performance of large scale batteries may be derived from the prototype cell studies.

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APPLICATIONS OF MULTIVALENT IONIC CONDUCTORS TO POLYMERIC ELECTROLYTE BATTERIES

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Fast ion conduction has been demonstrated in certain polymer materials doped with an alkali metal salt[1]. Polyethylene oxide (PEO) has been the most widely used polymer. It was found that PEO doped with a lithium salt such as $LiCF_3SO_3$ could give conductivity values of about 10^{-4} at 100°C[2]. The transport number of the Li^+ ion in these complexes has been found to be less than one. Despite this, the application of polymer electrolytes to solid state batteries has aroused considerable interest worldwide. The main attractive features such as high energy density, ease of fabrication of the battery components, variable geometry and long shelf life have led to proposed applications spanning across the whole battery product range from microelectronics to electric vehicle.

Cells utilizing the monovalent salt-polymer electrolyte, alkali metal anodes and cathodes based on insertion compounds have demonstrated good cycling and good reversibility at 100°C. Attempts have also been made to improve the conductivity of these polymer electrolytes by appropriate modifications for ambient temperature solid state batteries.

Recently divalent salts have also been used in the preparation of ionically conducting polymers [3,4]. Certain complexes (namely the Mg^{2+} based) were found to be anion conductors while others (namely the Pb^{2+} based) were cation conductors. It is therefore of interest to study the reasons for the apparent difference. A.c. conductivity measurements are currently being evaluated on a number of polymer divalent salt complexes. Electrochemical cells are being constructed with appropriate cathodes to assess the feasibility of these polymer electrolytes in rechargeable batteries. One such design

$$Mg|(PEO)_4 \cdot Mg(ClO_4)_2|V_6O_{13}$$

has an open circuit voltage of 2V and a theoretical energy density of 346 Wh/kg. Performance of large scale batteries may be derived from the prototype cell studies.

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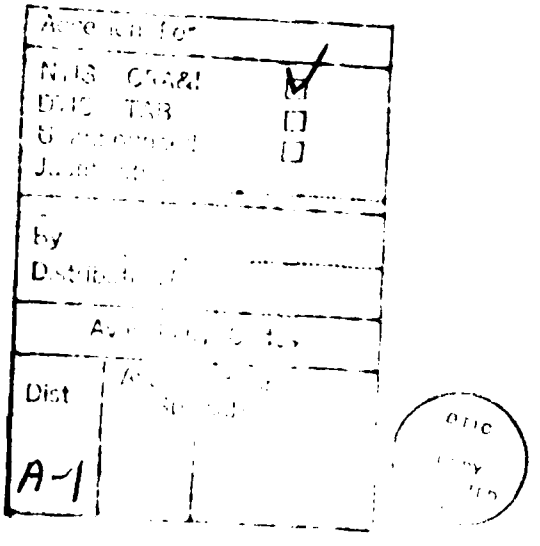

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